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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/617,912	07/11/2003	Mark D. Fokema	26048-013	4220

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EXAMINER

SINGH, PREM C

ART UNIT PAPER NUMBER

1764

DATE MAILED: 07/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/617,912

Applicant(s)

FOKEMA ET AL.

Examiner

Prem C. Singh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 June 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15, 17-34 and 36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15, 17-34 and 36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

Amendment to claims 1, 5, 17, 18, 28, and 29; cancellation of claim 16; withdrawal of claim 35; and addition of new claim 36, is noted.

Rejection of claim 5 under 35 USC § 112, second paragraph, is withdrawn.

Rejection of claims 1, 12, 13, 14, 16, and 24-32 under 35 U.S.C. 102(b) is withdrawn.

New rejection follows:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

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4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 5, 6, 10-14, 17-34, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khare (US 6,184,176 B1) in view of Eberly, Jr. et al. (US 4,464,252).

The Khare reference discloses the desulfurization of a hydrocarbon stream such as gasoline or diesel fuel. These streams contain sulfur compounds such as alkyl dibenzothiophenes. The process comprises contacting the hydrocarbon stream with a sulfur compound sorbent comprising an active metal oxide (e.g., zinc oxide) at temperatures ranging between 100° and 1000°F (38° to 538°C) and at preferred pressures ranging from 50 to 500 psi (345 kPa to 3.4 MPa). It is preferred that the contacting be carried out in the presence of hydrogen. Since this is a preferred embodiment, hydrogen does not need to be present in the process during the

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contacting. After the contacting stage, the adsorbent is regenerated by contacting the adsorbent with oxygen-containing gases such as air at preferred temperatures ranging from 800° to 1200°F (427° to 649°C). Example II discloses feeds with sulfur amounts within the claimed range. See column 3, lines 16-30 and 59-67; column 6, line 59 through column 7, line 45; and column 8, line 66 through column 9, line 8.

The Khare reference does not disclose a step of separating the product from the contacting step into a higher boiling fraction and a lower boiling fraction and does not disclose the recycling of the higher boiling fraction or the combusting of the higher boiling fraction to provide heat for the process.

Khare reference does not disclose the use of a molybdenum-containing sorbent.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process Khare by separating as claimed because separating hydrocarbons is a conventional step and one would separate in order to obtain desired fractions.

It also would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Khare by recycling any fraction to the desulfurization step because recycling would result in a product having lower amounts of sulfur.

It also would have been obvious to one having ordinary skill in the art at the time the invention was made to have combusted any product from the process to provide

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heat because the product from the process is a fuel and the process is conducted at elevated temperatures. Therefore, using the fuel from the process to provide heat for the process eliminates the need for an outside source of fuel thereby improving the economics of the process.

The Eberly reference discloses a process for removing sulfur from a hydrocarbon by using a sorbent containing MoO_3 on alumina. The sorbent is used in a process at temperature within the claimed range and without hydrogen. See column 2, lines 40-59; column 3, lines 6-43; and claim 1.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Khare by using a molybdenum-containing sorbent as suggested by Eberly because such sorbents are effective for removing sulfur from hydrocarbons at the conditions disclosed by Khare. Regarding the amounts of components in the sorbent and other characteristics of the sorbent, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have used sorbents having the claimed characteristics because one would adjust such characteristics to provide the most effective sorbent for removal of sulfur.

Claims 2, 3, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khare (US 6,184,176 B1) in view of WO 02/22763.

The Khare reference discloses the desulfurization of a hydrocarbon stream such as gasoline or diesel fuel. These streams contain sulfur compounds such as

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alkyldibenzothiophenes. The process comprises contacting the hydrocarbon stream with a sulfur compound sorbent comprising an active metal oxide (e.g., zinc oxide) at temperatures ranging between 100° and 1000°F (38° to 538°C) and at preferred pressures ranging from 50 to 500 psi (345 kpa to 3.4 MPa). It is preferred that the contacting be carried out in the presence of hydrogen. Since this is a preferred embodiment, hydrogen does not need to be present in the process during the contacting. After the contacting stage, the adsorbent is regenerated by contacting the adsorbent with oxygen-containing gases such as air at preferred temperatures ranging from 800° to 1200°F (427° to 649°C). Example II discloses feeds with sulfur amounts within the claimed range. See column 3, lines 16-30 and 59-67; column 6, line 59 through column 7, line 45; and column 8, line 66 through column 9, line 8.

The Khare reference does not disclose the contacting of the hydrocarbon with an acidic inorganic material as claimed to effect reduction of the average molecular weight of the fuel and produce hydrogen sulfide.

The WO reference discloses a process for the removal of sulfur from hydrocarbon fuels by contacting the fuels with a metal oxide sorbent mixed with a cracking catalyst such as a catalyst comprising a zeolite. See entire document, especially pages 12 and 18.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Khare by including a cracking catalyst in the contacting step as suggested by the WO reference because the cracking results in the production of valuable products.

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Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khare (US 6,184,176 B1) in view of WO 02/22763 as applied to claim 3 above, and further in view of Chen et al. (US 4,911,823).

The previously discussed references do not disclose the use of a mixture of zeolite beta and ZSM-5 as the acidic inorganic material.

The Chen reference discloses that a mixture of zeolite beta and ZSM-5 is effective in cracking hydrocarbons. See column 8, lines 23-28.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the teachings of the previously discussed references by using a mixture of zeolite beta and ZSM-5 as the cracking component as suggested by Chen because octane number of the product will be improved.

Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Khare (US 6,184,176 B 1) as applied to claim 5 above, and further in view of Michlmayr (US 4,179,361).

As discussed above, the Khare reference does not disclose the use of a secondary desulfurization agent.

The Michlmayr reference discloses a two-stage adsorption process for desulfurizing oil feed containing thiophenes. See column 3, lines 5-25.

It would have been obvious to one having ordinary skill in the art at the time the

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invention was made to have modified the process of Khare by including a second adsorption step as suggested by Michlmayr because sulfur impurities will be further removed resulting in a purer product.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Khare (US 6,184,176 B1) in view of Michlmayr (US 4,179,361) as applied to claim 8 above, and further in view of WO 02/22763 A1.

The previously discussed references do not use the desulfurization agent of claim 9.

The WO reference discloses sorbents that contain zinc oxide, copper, and alumina. See Page 18.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the teachings of the previously applied references by using the sorbent of the WO reference because these sorbents are effective for sulfur removal and therefore would be expected to be effective in the prior art process.

Response to Arguments

The Applicant argues that Khare offers no motivation for or suggestion of removing sulfur via a conversion of a metal oxide to a metal sulfide and then back to metal oxide in a regeneration process. Eberly discloses a catalyst that includes metal oxides. Eberly however, is directed to the removal of sulfur from lighter hydrocarbon

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species in naphtha rather than the removal of sulfur from heavier species in a hydrocarbon fuel.

The Applicant's argument is not persuasive because Eberly discloses using molybdenum and tungsten oxides to "Catalytically remove sulfur from petroleum fractions, crude oils, and other mixtures of hydrocarbons" (Column 1, lines 12-20).

The Applicant argues that Eberly uses only light feed and conducts the desulfurization at the relatively low temperature of 350°F and nowhere suggests desulfurizing at the higher temperature of at least 350°C.

The Applicant's argument is not persuasive because Eberly suggests using petroleum fractions, crude oils, and other mixtures of hydrocarbons. Eberly also suggests sulfur removal from naphtha at temperatures ranging from 100°F to 600°F (38 °C to 316°C) (Column 2, line 50). It would have been obvious to one skilled in the art at the time the invention was made to use higher temperatures for adsorption, if the feed was heavier than naphtha.

The Applicant argues that neither Eberly nor Khare nor any of the other references are directed to removing sulfur from refractory organosulfur compounds in heavy fuels using the recited metal oxides; and, therefore, they offer no motivations for sulfur-removal mechanism described in Applicants' amended claims.

The Applicant's argument is not persuasive because Khare removes alkyldibenzothiophenes from gasoline and diesel fuels using zinc oxide. Eberly does not

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specifically mention the type of sulfur compound. It would have been obvious to one skilled in the art at the time the invention was made to combine Khare and Eberly inventions and use the molybdenum oxide adsorbent disclosed by Eberly and use in the setup of Khare to remove the refractory organosulfur from different hydrocarbons.

The Applicant argues that WO 02/22763 also discloses a sulfur removal process involving metal oxides; however it fails to offer any suggestion or motivation for using the recited metal oxides as described in Applicant's amended claims.

The Applicant's argument is not persuasive because WO 02/22763 discloses using vanadium oxide (Page 9, paragraph 1). It is to be noted that the Applicant uses tantalum oxide and both vanadium and tantalum belong to Group V of the Periodic Table. Thus, it is expected that vanadium oxide will be as effective as tantalum oxide in removing sulfur from hydrocarbon streams.

The Applicant finally argues about absence of a disclosure or suggestion of the metal-oxide to metal-sulfide and back mechanism for sulfur removal and regeneration involving the recited metal oxides, particularly in the absence of added hydrogen gas and at higher temperatures.

The Applicant's argument is not persuasive because Eberly discloses, "In accordance with the present invention, a spent Group VI B and/or Group VIII metal containing catalyst having had deposited on it, by virtue of its use, coke, sulfur, and/or additional nickel and vanadium is regenerated by contact with a stream of an oxygen-

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containing gas, preferably air, or air/inert mixture such regeneration converting metals to their oxides." (Column 2, lines 26-34). "The catalyst was regenerated by contacting with an oxygen/nitrogen mixture and burning off the coke and sulfur at 600-800°F over a period of 24 hours." (Column 3, lines 17-20).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on MF 8-5.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ps/070506

A handwritten signature in black ink, appearing to read "Zam", is written over a horizontal line.